

### **3.6.6    Organic Sludge Focus Area**

Organic compounds buried in the SDA include carbon tetrachloride, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, tetrachloroethylene, heavy lubricating oils, polychlorinated biphenyls, chlorofluorocarbons, alcohols, organic acids, EDTA (also known as Versenes), and nitrobenzene. From the IRA (Becker et al. 1998), the primary contributors to potential risk from organic sludge were carbon tetrachloride, methylene chloride, and tetrachloroethylene. Ninety-eight percent of the carbon tetrachloride was originally contained in Rocky Flats Plant Series 743 sludge. Information from WasteOScope indicated that the eastern end of Pit 4 contained many drums containing Series 743 sludge. High VOC soil-gas concentrations that have been detected over the eastern end of Pit 4 corroborated that drums containing Series 743 sludge were buried there. The VOC concentration was corroborated further from results of Type A logging. Most of these probes logged with the n-gamma tool indicated elevated chlorine detections across the focus area. Chlorine is indicative of chlorine-bearing waste (e.g., VOCs and polyvinyl chloride plastic).

Investigation in the eastern end of Pit 4 was undertaken primarily to collect data to evaluate the mass of VOCs remaining in the buried waste by using a combination of shallow and waste zone vapor probes, nuclear logging of the Type A probes, flux chamber measurements, and modeling. A long transect of Type A probes first was installed in the eastern side of Pit 4 (see Figure 3-36). The investigated area contained a significant quantity of organic sludge. The probe transect was designed to originate in an area where VOC-containing waste drums were heavily concentrated and to extend to an area with minimal VOC-containing waste. The transect passed through 30 delineated waste shipments recorded for the area in Pit 4. Of these disposals, 26 originated from Rocky Flats Plant and contained Series 743 sludge, which contains high concentrations of VOCs. The 30 disposals contained approximately 2,819 drums, of which 1,077 (i.e., 38%) were drums of Series 743 sludge (Becker et al. 2000). Using WasteOScope, shallow soil-gas and geophysical data were used to aid in placing the transect.

Figure 3-37 displays an example of a recent soil-gas survey and shows that high levels of carbon tetrachloride are in the northeastern corner of Pit 4; this corresponds well with disposal records described previously. After the original probe transect was placed, the survey was conducted; data are given here because the data set is more current than the original shallow soil-gas survey data. Figure 3-38 illustrates an electromagnetic geophysical survey conducted over the same area. This survey indicates the presence of metallic objects, probably drums, in a wide area of the eastern section of Pit 4 and also indicates substantially less metallic material in the southern portion of Pit 4. Data from these types of surveys supported the plan to place probes over a transect covering a high-to-low concentration of VOC-bearing waste.

Multiple disposals of organic sludge were concentrated in the eastern end of Pit 4. Accordingly, precision was less important in choosing locations for Type B clusters. Three primary probe cluster locations were chosen to cover a large areal extent of the transect and also to cover a range of chlorine detections generated from nuclear logging data.

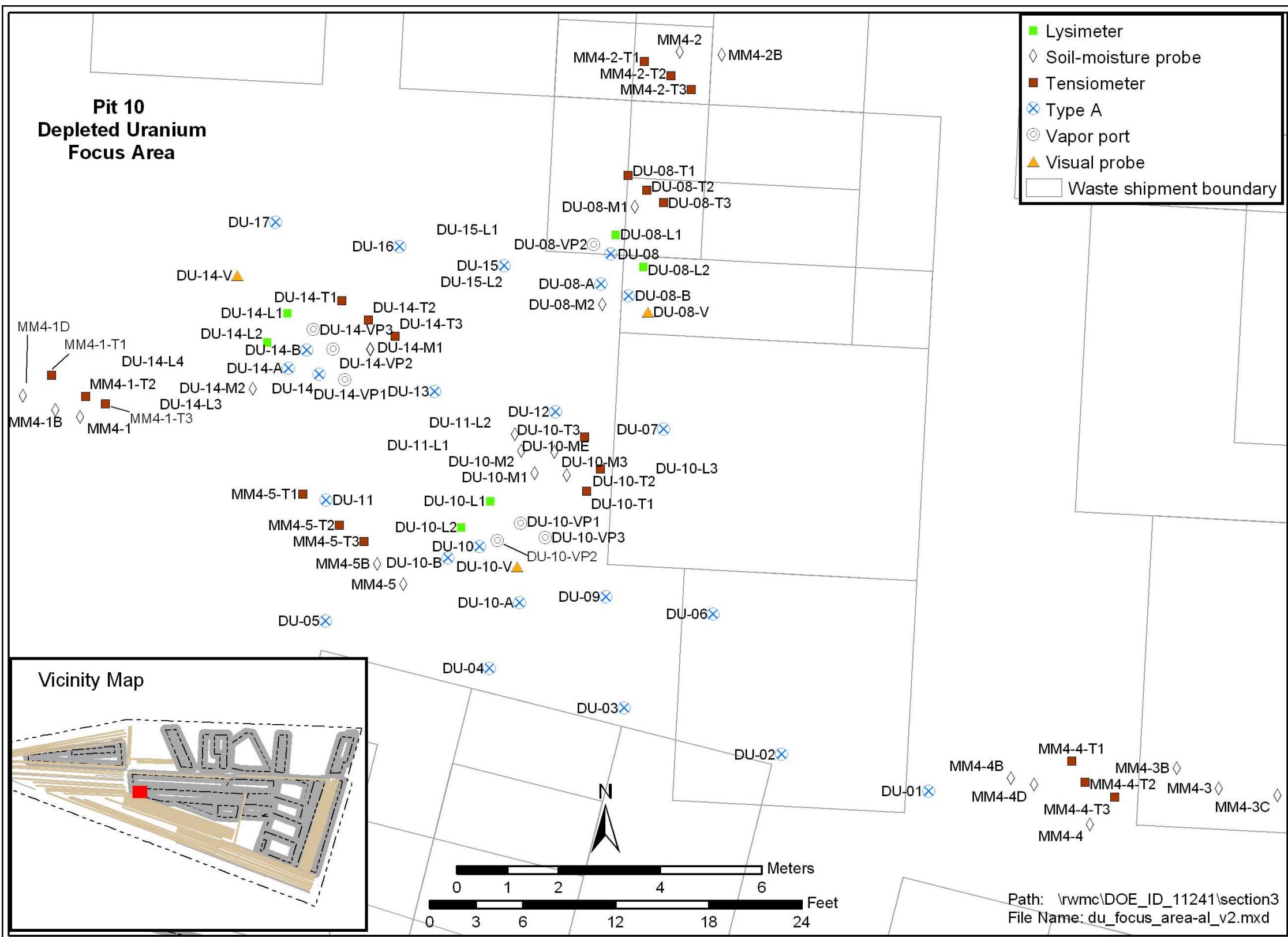


Figure 3-35. Probe clusters installed in and around the Depleted Uranium Focus Area in the western end of Pit 10.



Table 3-30. Clusters of probes in the western end of Pit 10 and the eastern end of Pit 4 supporting depleted uranium waste assessment.



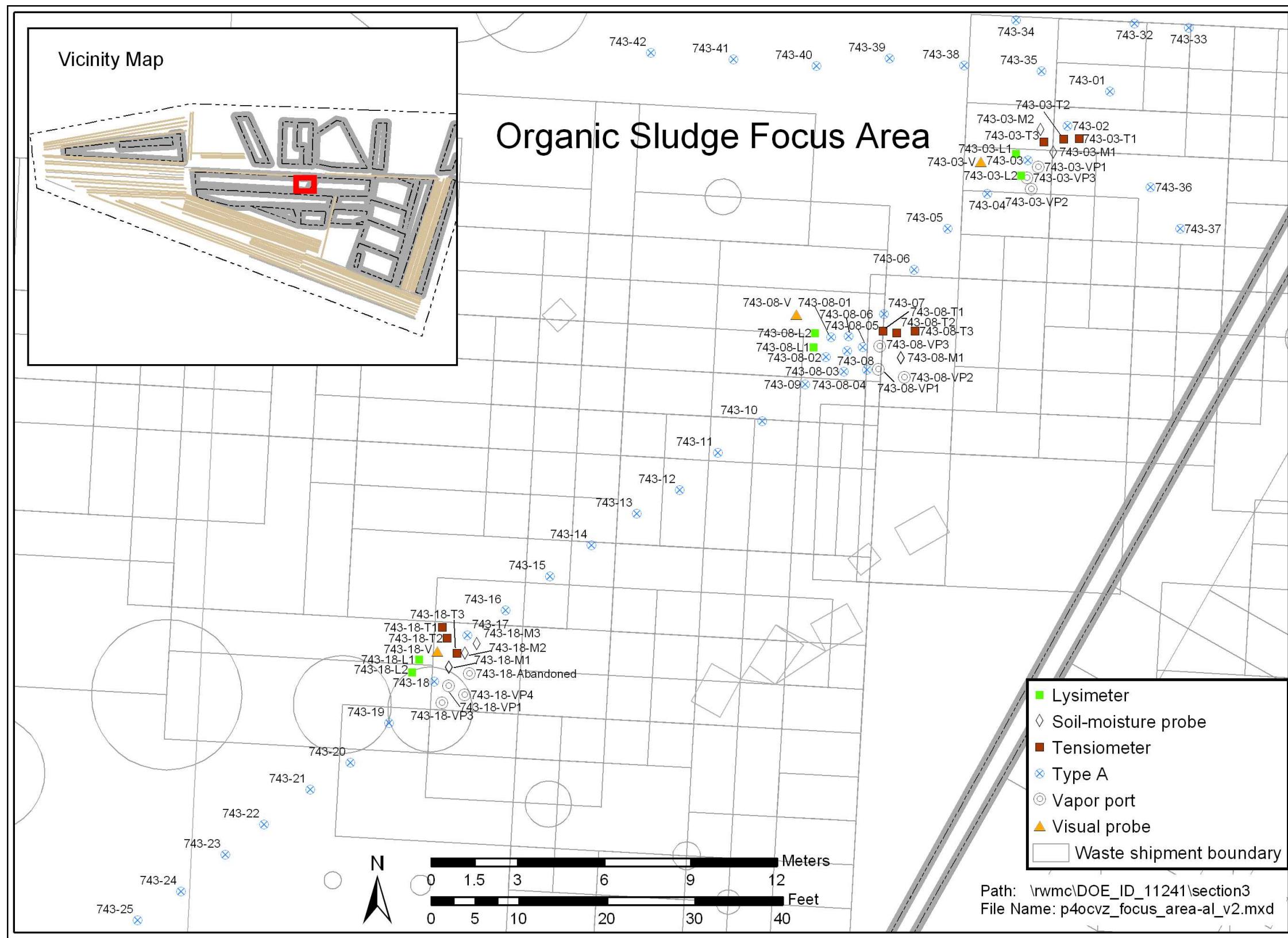


Figure 3-36. Probes installed in the Organic Sludge Focus Area in the eastern end of Pit 4.



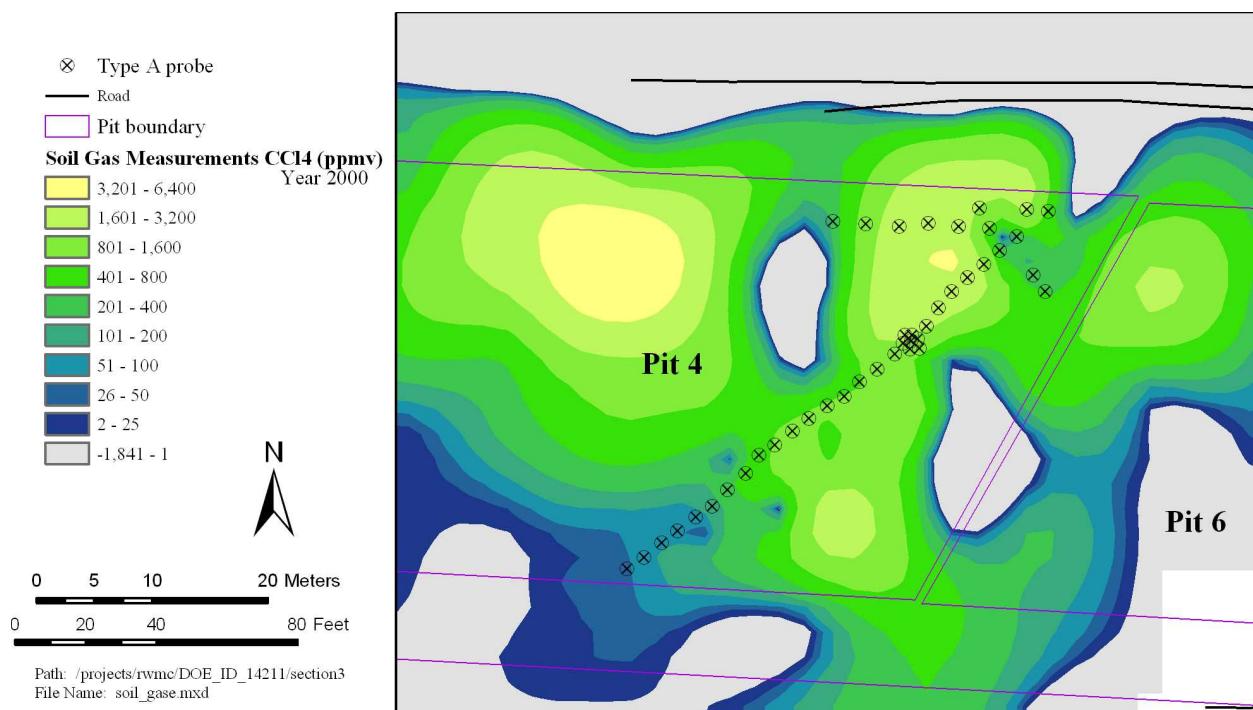


Figure 3-37. Relationship of shallow soil-gas survey and Type A probe placement in the eastern end of Pit 4.

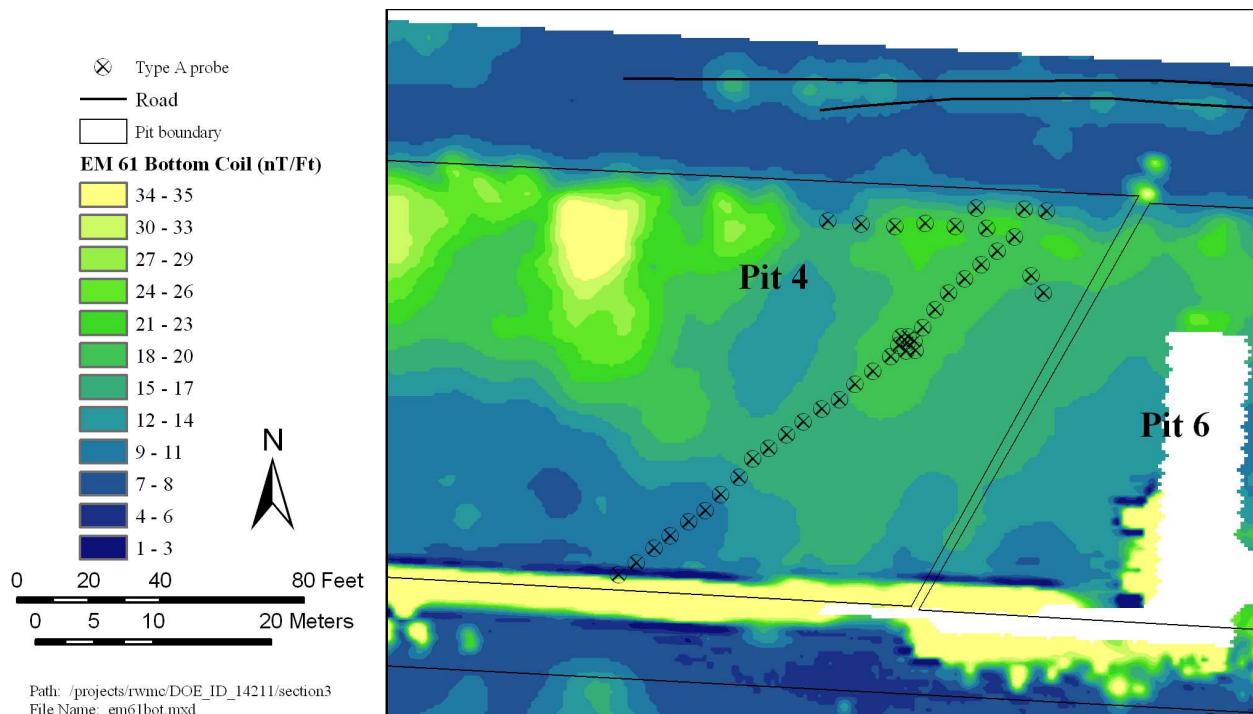


Figure 3-38. Relationship of geophysical survey and Type A probe placement in the eastern end of Pit 4.

Location 743-03 was chosen as the origin of a probe cluster because it had the highest chlorine signature collected from any Type A probe along the transect. According to WasteOScope, this location also contained numerous organic sludge disposals, and previous soil-gas surveys indicated elevated VOC concentrations. Location 743-08 was selected for much the same reason. In addition, this location contained the largest detection of U-238 daughter products, and thus was able to provide valuable information about depleted uranium characteristics in addition to data about organic sludge. Location 743-18 was selected because it is in the transition area between disposals that contain organic sludge and those that do not. Type A logging data indicated presence of chlorine, but at substantially lower concentrations than identified at Probes 743-03 and 743-08. Data interpretations used to locate the Type B probe clusters are given in Appendix D in Salomon (2001). The types and completion depths of probes used to form clusters in the Organic Sludge Focus Area are listed in Table 3-31.

### 3.6.7 Americium and Neptunium Focus Area

The primary source of Am-241 and Np-237 in the SDA is Rocky Flats Plant Series 741 sludge (i.e., first stage waste water sludge). An area in the central part of Pit 10 was identified as the Americium and Neptunium Focus Area. Disposal numbers<sup>h</sup> 195, 196, 205, 206, and 207 in that location were of special interest for two reasons: (1) the disposals contain relatively large numbers of Series 741 drums and (2) the Series 741 drums occur in high ratios relative to other types of waste drums in the same disposals. For example, Disposals 195 and 196 contained 301 drums, and 169 of those drums contained Series 741 sludge. Similarly, Disposals 205, 206, and 207 contained 293 drums, 137 of which contained Series 741 sludge. Specific contents of the shipments are listed in the Operable Unit 7-13/14 Probehole Plan (Becker et al. 2000). The Probehole Plan also provides the rationale and figures from past geophysical surveys to support placing the probes in this focus area. Historical disposal information was used to demarcate a general area, then geophysical survey data were used to refine the probe location selection. Initial probe data were evaluated to further refine additional probe locations.

The Americium and Neptunium Focus Area was investigated to determine a fingerprint of this high-activity waste stream in the SDA environment. Both Am-241 and Np-237 were identified as contaminants of potential concern in the IRA (Becker et al. 1998). Though the waste may have contained Np-237 at the time of disposal, some Np-237 is produced through decay of Am-241. The primary waste stream containing Am-241 is the Series 741 sludge, which contains more than 80% of the Am-241 buried in the SDA. This waste stream was disposed of from 1954 to 1970.

Locations of probes installed in the Americium and Neptunium Focus Area are shown in Figure 3-39. Location 741-08 had higher observed concentrations of Pu-239, Am-241, and Np-237 than other locations in this focus area. In addition, Location DU-08 in the Depleted Uranium Focus Area (see Figure 3-35) contained an excellent source for monitoring neptunium waste. The primary clusters and probes used to characterize the Americium and Neptunium Focus Area are listed in Table 3-32.

As noted in Section 3.6.5, the other Type A probe used to establish a probe cluster to study americium and neptunium waste was identified in the Depleted Uranium Focus Area. Nuclear logging data from this probe indicated that the highest concentration of neptunium-bearing waste was detected at Location DU-08. A cluster was installed there to monitor this type of waste. Probes installed at Location DU-08 are illustrated in Figure 3-35, which shows the Depleted Uranium Focus Area in the western end of Pit 10.

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h. Disposal numbers are artifacts of early versions of WasteOScope and were applied in probehole planning documents, figures, and other aspects of probing implementation. These numbers are no longer used.

Table 3-31. Clusters of probes in the Organic Sludge Focus Area in the eastern end of Pit 4.

Probe Type												
	Type A Probe		Tensiometer		Soil-Moisture Probe		Lysimeter		Vapor Port		Visual Probe	
Cluster Name	Probe Name	Probe Depth (ft)	Probe Name	Instrument Depth (ft)	Probe Name	Instrument Depth (ft)	Probe Name	Port Depth (ft)	Probe Name	Port Depth (ft)	Probe Name	Probe Depth (ft)
<b>743-03</b>												
	743-03	19.5	743-03-T3	18.5	743-03-M1	19.1	743-03-L1	12.8	743-03-VP1	18.0	743-03-V	13.6
	—	—	743-03-T2	11.2	743-03-M1	12.3	743-03-L2	9.8	743-03-VP2	13.3	—	—
	—	—	743-03-T1	5.3	743-03-M1	3.4	—	—	743-03-VP3	4.8	—	—
<b>743-08</b>												
3-149	743-08	25.3	743-08-T3	22.4	743-08-M1	22.3	743-08-L1	23.3	743-08-VP1	20.2	743-08-V	13.6
	743-08-1	25.6	743-08-T2	13.0	743-08-M1	13.9	743-08-L2	9.0	743-08-VP2	13.4	—	—
	743-08-2	25.0	743-08-T1	5.6	743-08-M1	6.6	—	—	743-08-VP3	4.9	—	—
	743-08-3	26.3	—	—	—	—	—	—	—	—	—	—
	743-08-4	25.1	—	—	—	—	—	—	—	—	—	—
	743-08-5	25.0	—	—	—	—	—	—	—	—	—	—
	743-08-6	25.1	—	—	—	—	—	—	—	—	—	—
<b>743-18</b>												
	743-18	21.0	743-18-T2	14.9	743-18-M1	19.2	743-18-L2	12.8	743-18-VP1	20.0	743-18-V	12
	—	—	743-18-T3	9.2	743-18-M1	12.8	743-18-L1	12.1	743-18-VP3	7.6	—	—
	—	—	743-18-T1	5.5	743-18-M1	6.5	—	—	743-18-VP4	14.6	—	—

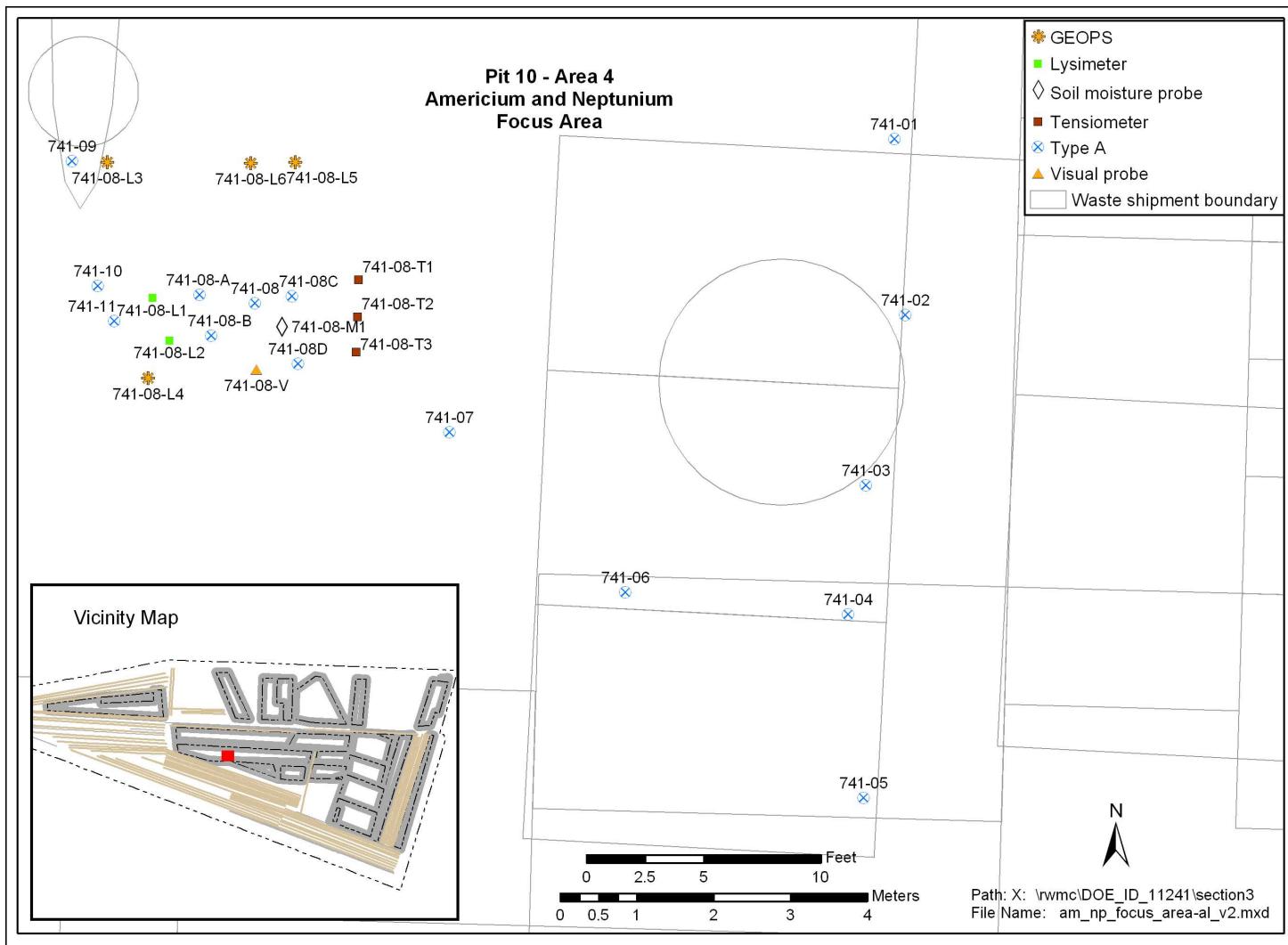


Figure 3-39. Probes installed in the Americium and Neptunium Focus Area in the central part of Pit 10.

Table 3-32. Clusters of probes supporting waste assessment of americium and neptunium in Pit 10.

Probe Type												
Type A Probe		Tensiometer		Soil-Moisture Probe		Lysimeter		Vapor Port		Visual Probe		
Cluster Name	Probe Name	Probe Depth (ft)	Probe Name	Instrument Depth (ft)	Probe Name	Instrument Depth (ft)	Probe Name	Port Depth (ft)	Probe Name	Port Depth (ft)	Probe Name	Probe Depth (ft)
<b>DU-08</b>												
	DU-08	18.7	DU-08-T3	16.4	DU-08-M1	17.9	DU-08-L1	16.1	DU-08-VP2	15.8	DU-08-V	17.6
	DU-08-A	18.1	DU-08-T2	10.2	DU-08-M1	11.5	DU-08-L2	14.1	—	—	—	—
	DU-08-B	17.6	DU-08-T1	5.3	DU-08-M1	6.1	—	—	—	—	—	—
	—	—	—	—	DU-08-M2	12.08	—	—	—	—	—	—
	—	—	—	—	DU-08-M2	6	—	—	—	—	—	—
	—	—	—	—	DU-08-M2	18.6	—	—	—	—	—	—
<b>741-08</b>												
3-151	741-08	22.3	741-08-T3	19.9	741-08-M1	19.9	741-08-L1	15.2	—	—	741-08-V	13.5
	741-08-A	20.8	741-08-T2	10.6	741-08-M1	11.5	741-08-L2	7.8	—	—	—	—
	741-08-B	21.8	741-08-T1	3.6	741-08-M1	4.1	741-08-L3	15.2	—	—	—	—
	—	—	—	—	—	—	741-08-L4	7.7	—	—	—	—
	—	—	—	—	—	—	741-08-L5	15.1	—	—	—	—
	—	—	—	—	—	—	741-08-L6	11.0	—	—	—	—